

Claims:

1. A method of processing a semiconductor device, comprising the steps of:

generating plasma in a processing chamber to form a thin film on a semiconductor device or to process a thin film formed on a semiconductor device;

scanning a laser beam which intensity is modulated at a desired frequency

inside the processing chamber where the semiconductor device is being processed by the plasma through a window;

receiving by a sensor through the window a back scattered light being scattered from fine particles suspended in said processing chamber by scanning the laser;

detecting said desired frequency component from a signal outputted from the sensor;

obtaining information from the detected desired frequency component relating to quantity, size and distribution of fine particles illuminated by said laser beam inside the processing chamber; and

outputting said obtained information relating to quantity, size and distribution of the fine particles.

2. A method of processing a semiconductor device according to the claim 1, wherein the laser beam has a desired wavelength component and the desired wavelength component is received by the sensor separated from the other wavelength components in the step of receiving the back scattered light.

3. A method of processing a semiconductor device according to the claim 1, wherein the laser beam is polarized in P-polarization and the window has a Brewster's angle relative to the P-polarized laser beam.

4. A method of processing a semiconductor device according to the claim 1, wherein the obtained information involves a two dimensional distribution information of the fine particles along an optical axis and a scan direction of the laser beam.

5. A method of processing a semiconductor device according to the claim 4, wherein the two dimensional distribution information includes a distribution of the fine particles along an optical axis and a scan direction of the laser beam.

6. A method of processing a semiconductor device according to the claim 1, wherein the desired frequency for modulating the laser beam is different from a frequency for generating the plasma inside the processing.

7. A method of processing a semiconductor device, comprising the steps of:

- coating resist on a surface of a substrate;
- exposing said resist coated on said substrate with a desired light pattern;
- developing said exposed resist;
- processing said substrate with plasma and the surface of the substrate is partially covered with the developed; and
- removing said resist coated on the substrate on which said patterns are formed;

wherein in the processing step, the substrate is processed in a processing apparatus and a laser beam is scanned inside the processing apparatus through a window of the processing apparatus and a back scattered light from

fine particles by the scanned laser beam is detected through the window.

8. A method of processing a semiconductor device according to the claim 7, wherein from said detected back scattered light an information of distribution of fine particles suspending inside the processing apparatus is obtained.

9. A method of processing a semiconductor device according to the claim 7, wherein an intensity of the laser beam scanning inside the processing apparatus is modulated at a desired.

10. A method of processing a semiconductor device, comprising the steps of:

forming a thin film on a substrate;  
coating a resist on said substrate on which said thin film is formed;  
exposing said resist with a light pattern by using an exposing apparatus;  
developing said exposed resist by using a developing apparatus;  
etching said thin film on which said resist is developed and forming hole patterns by using a plasma etching apparatus; and  
removing said resist coated and developed on said substrate on which said hole patterns are formed in said thin film;  
wherein in said etching step, a laser beam is scanned inside said plasma etching apparatus where a plasma is generated and back scattered light from fine particles suspended inside said plasma etching apparatus is detected by a sensor separated from reflected light from a wall of said plasma etching apparatus.

11. A method of processing a semiconductor device according to the claim 10, wherein an intensity of said laser beam scanning inside said plasma etching apparatus is modulated at a desired frequency.
12. A method of processing a semiconductor device according to the claim 10, wherein from said detected back scattered light an information regarding sizes and distribution of fine particles suspended inside said plasma etching apparatus is obtained.
13. A method of processing a semiconductor device according to the claim 10, wherein from said detected back scattered light in said etching step, obtaining a two dimensional distribution information of fine particles suspended inside said plasma etching apparatus.
14. A method of processing a semiconductor device according to the claim 13, wherein the two dimensional distribution information includes a distribution of fine particles along an optical axis and a scan direction of the laser beam.
15. A method of processing a semiconductor device according to the claim 13, wherein the information regarding said distribution of said fine particles is displayed on a monitor.
16. A method of processing a semiconductor device according to the claim 13, wherein an information regarding contamination of inside said plasma etching apparatus is obtained from the detected back scattered light from the fine particles.
17. A method of processing a semiconductor device comprising the steps

of:

loading a substrate into a chamber of a plasma etching apparatus, on a surface of the substrate, a resist pattern is formed;

evacuating inside said chamber in which said substrate is loaded and supplying a process gas inside said chamber;

applying high frequency power to an electrode of said plasma etching apparatus and generating plasma inside said chamber;

processing said substrate with said plasma;

illuminating a laser beam inside said chamber through a window of said plasma etching apparatus and detecting through said window a back scattered light generated by fine particles suspended inside said chamber; and

unloading said substrate from said plasma etching apparatus after stopping said supply of said process gas and evacuating said process gas from inside said chamber.

18. A method of processing a semiconductor device according to the claim 17 wherein an intensity of said laser beam illuminates inside said chamber is modulated at a desired frequency.

19. A method of processing a semiconductor device according to the claim 17 wherein an information is obtained from said detected back scattered light regarding fine particles suspended inside said chamber.

20. A method of processing a semiconductor device according to the claim 19 wherein said obtained information regarding said fine particles is information regarding sizes and distribution of fine particles suspended inside said chamber.

21. A method of processing a semiconductor device according to the claim 20 wherein said information regarding size and distribution of said fine particles suspended inside said chamber is displayed on a monitor.

22. A method of processing a semiconductor device according to the claim 17 wherein, based on a detection signal detected from light scattered by said fine particles, information regarding contamination status inside said plasma etching apparatus is output.

23. A method of processing a semiconductor device according to the claim 17, wherein an information regarding contamination of inside said plasma etching apparatus is obtained from the detected back scattered light.